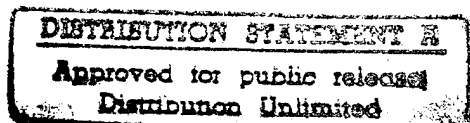


**An Exploratory Study on
The Effectiveness of Event-Related Stimuli
as a Control Procedure in the
Psychophysiological Detection of Deception**

William J. Yankee, Ph.D.



October 1993

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)

2. REPORT DATE
October 1993

3. REPORT TYPE AND DATES COVERED
Final Report (From Mar 93 to Oct 93)

4. TITLE AND SUBTITLE

An Exploratory Study on The Effectiveness of
Event-Related Stimuli as a Control Procedure
in the Psychophysiological Detection of Deception

5. FUNDING NUMBERS

DoDPI93-P-0030

6. AUTHOR(S)

William J. Yankee

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Department of Defense
Polygraph Institute Bldg 3195
Fort McClellan, AL 35205

8. PERFORMING ORGANIZATION
REPORT NUMBER

DoDPI93-R-0003

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Department of Defense
Polygraph Institute
Building 3195
Fort McClellan, AL 36205-5114

10. SPONSORING/MONITORING
AGENCY REPORT NUMBER

DoDPI93-P-0030
DoDPI93-R-0003

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Public release, distribution unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

To evaluate if event-related relevant questions could serve as control questions to discriminate between programmed guilty persons (PGP) and programmed innocent persons (PIP), rank order scoring was applied to the test results of forty individuals evenly and randomly assigned to innocent and guilty groups. The results showed that event-related relevant questions can be used as controls and will discriminate PGP from PIP.

DISTRIBUTION STATEMENT E

Approved for public release
Distribution Unlimited

14. SUBJECT TERMS

psychophysiological detection of deception, PDD,
control question tests, event-related questions,
event-related controls.

15. NUMBER OF PAGES

31

16. PRICE CODE

17. SECURITY CLASSIFICATION
OF REPORT

Unclassified

18. SECURITY CLASSIFICATION
OF THIS PAGE

Unclassified

19. SECURITY CLASSIFICATION
OF ABSTRACT

Unclassified

20. LIMITATION OF ABSTRACT

Report No. DoDPI93-R-0003

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Director's Foreword

This was the first attempt to develop a psychophysiological detection of deception (PDD) test that might correct for the several limitations and criticisms (see the text for details) that have been directed toward Control Question Tests. The approach in this study was based on the hypothesis that an innocent person will respond differently to a list of relevant questions regarding an event they were not involved in than a guilty person, who was involved in the event, would. (See the text for the complete rationale). As such, the testing format did not contain control, irrelevant, or symptomatic questions. Rather, all questions were relevant, event-related and associated with the case issues reviewed during the pretest interview. The case issues were based on an espionage and sabotage scenario.

The results of this exploratory study provide sufficient evidence to conclude that under the conditions of this study, an all relevant question test can discriminate between programmed guilty persons (PGP) and programmed innocent persons (PIP). The rank order scoring system used in this exploratory study is rather crude and based on subjective evaluative judgements of the physiological data in correlation with the test questions asked. In an attempt to improve on the diagnostic accuracy of this test, the data collection projects that are planned will be used to develop a data base for an artificial neural network (ANN) algorithm which, it is assumed, will be more objective and precise in evaluating the data for diagnostic purposes.

A handwritten signature in black ink, reading "Michael H. Capps". The signature is fluid and cursive, with the first name "Michael" and last name "Capps" clearly legible.

Michael H. Capps
Director

Acknowledgments

The author wishes to thank Charles Slupski, CW4, Army CID Agent; and, GySGT Keith Gaines, U.S. Marine CID Agent, both assigned to the Department of Defense Polygraph Institute (DoDPI) as Instructors, for serving as examiners in this study. Their willingness to try a new approach to PDD testing, and to use a new cardiovascular recording device (Finapres) at the same time is commendable.

Also thanks to Brenda Smith for organizing and programming the examinees and to Jeff St. Cyr and Linda Knickerbocker for escorting the examinees and managing files and records. Their efforts enhanced and promoted the successful completion of the data collection phase and of the project. This research was supported by Department of Defense Polygraph Institute project DoDPI93-P-0030 funds. The views expressed in this article are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

Abstract

YANKEE, W. J. An exploratory study on the effectiveness of event-related stimuli as a control procedure in the psychophysiological detection of deception. October 1993, Report No. DoDPI93-R-0003. Department of Defense Polygraph Institute, Ft. McClellan, AL 36205.--To evaluate if event-related relevant questions could serve as control questions to discriminate between programmed guilty persons (PGP) and programmed innocent persons (PIP), rank order scoring was applied to the test results of forty individuals evenly and randomly assigned to innocent and guilty groups. The results showed that event-related relevant questions can be used as controls and will discriminate PGP from PIP.

Key-words: psychophysiological detection of deception, PDD, control question tests, event-related questions, event-related controls.

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The psychophysiological detection of deception (PDD) is one of the two most commonly used applications of psychophysiological systems and processes (Coles, Donchin and Porges, 1986). These PDD applications, more commonly known as PDD tests, can be organized into three categories: Relevant-Irrelevant Tests (RIT); Control Question Tests (CQT); and Knowledge Based Tests (KBT). The RIT's were the most widely used tests through the late thirties, forties and early fifties (Lykken, 1981) and were subsequently replaced, for most criminal matters, by the CQT's (Ben-Shakar, 1991) beginning in the late forties. See Lykken (1981), Raskin (1979), and (1986) as well as Iacono and Patrick (1988), for a description of how RI tests were, and are, administered and for a critique of the RIT's in general. Also see Raskin (1979); Lykken (1981); Iacono and Patrick (1988); Furedy and Heslegrave (1991); and Furedy (1986) for a review of how control question tests are administered and for evaluations of their limitations.

The use of CQTs have been supported and defended by some scientists as being a valid and reliable means of discriminating between innocent and guilty subjects (Barland and Raskin, 1975; Podlesny and Raskin, 1977; Raskin, 1978; Raskin, Barland and Podlesny, 1977; Raskin and Hare, 1978; and Reid and Inbau, 1977) while other scientists, as will be presented later, have been persistently critical. The major criticisms regarding the CQTs are fourfold. First, it is argued that the control questions used in a CQT are not, from a psychometric and scientific point of view, real controls (Furedy, 1986). The relevant questions are "event-related" or "specific" to the relevant issue under investigation, (e.g. Did you steal that wallet?), whereas the control questions are "event free" in the sense that they do not relate directly to the issue and are generally broader in scope, (e.g. Before the age of 18, did you ever steal anything of value?) (Furedy and Heslegrave, 1991).

Secondly, the method does not assure that the physiological responses to control questions can provide responses that will override the significance of the relevant questions for the innocent person (Lykken, 1981). Thirdly, the recorded physiological activity gathered during the test procedures are subject to manipulation, generally called countermeasures by knowledgeable and trained examinees and thus could decrease the diagnostic accuracy of the CQT (Honts and Hodes, 1982; Honts, Raskin and Kircher, 1983). Fourth, some of the procedures associated in the development of control questions with the examinee during the pretest phase of an examination are said to be deceptive, e.g. convincing the subject that the test is infallible; and, possibly unethical, e.g. deceiving the subject regarding the use and purpose of the control questions (Iacono and Patrick, 1988; Lykken, 1981).

Many scientists (Lykken, 1981; Iacono and Patrick, 1988; Furedy and Heslegrave, 1986; and Furedy, 1986) propose and advocate one type of the knowledge-based tests, the Guilty Knowledge Test (GKT), as a scientifically sound test and one that corrects for most of the flaws and deficiencies of the CQTs. The GKT, however, like the CQTs and the RITs, also has some serious limitations: the procedures and format have never been field tested; it cannot be used when important case facts have been publicized or in other ways known to a suspect; and it can't be used, in many instances, when the case is a "one on one" such as in some rape cases; in exculpatory conditions; or in most confirmatory tests.

Over the years, the CQTs have established a reputation for resolving issues in many forensic investigations and thus have a robust and high utility profile. It is especially high in case resolution utility, when it is compared with the case resolution utility of other forensic sciences (Light and Schwartz, 1992). If the use of the CQTs were to be abandoned, as some scientists have specifically proposed (Furedy and Heslegrave 1991), the loss of these important forensic tools would seriously impact the crime clearance rate (criminal, intelligence and counterintelligence) in the criminal justice system, since the substitution of GKTs could not match the widespread specific issue application of the CQTs. Consequently, it seems that other PDD tests or knowledge-based tests, that will transcend the flaws of the RITs, the problems with the CQTs, and the limitations of the GKTs, must be developed.

In 1963, Sokolov distinguished between reactions to probing versus neutral questions by noting that the orienting response to neutral questions adapts rather easily, while probing questions require more processing of information with more attendant decision making requirements (McGuigan, 1978). Raskin and Kircher, 1991 purport that differential signal value of control versus relevant questions provides the basis for detecting deceptive subjects for both the GKT and the CQT. Lykken, 1959, on the other hand, purports that the GKT does not detect deception, but rather the presence of guilty knowledge, and thus a guilty person, will show some involuntary physiological response to stimuli related to remembered details of his crime. Lykken, 1959 also proposes that "as long as a subject is able to comprehend the situation and to respond more intensely to a question having some special significance for him than he does to most of the questions, the method is not compromised in its ability to differentiate innocence from guilt" (page 386).

During the commission of a crime, perpetrators will make many observations in regard to the who, what, where, when, why, and how they approached the crime scene, executed the crime, and departed from the scene. Some of these observations will be of

more interest and significance to the individual, attended to more intensely and thus more likely to be encoded in long term memory where it will be stored and can be retrieved. Other sensory input will draw attention but that attention may be diverted by other more significant meaningful stimuli, and stored in short term memory where, if the information is not rehearsed it will be lost (Bernstein et. al., 1988). Hence if a variety of relevant questions are developed, based on the total circumstances of the crime, some of the questions, as Lykken has proposed, will have more signal value or special significance to the individual than other questions. Consequently, it seems plausible that a guilty person may respond more intensely when event related questions which prod the strong signal value items are asked than when event related questions of less or no signal value are asked.

It would seem then that if a PDD test were used, consisting of a series of relevant questions all related to the same "crime event circumstances," that the psychological value of each of the questions would differ on the basis of the significance of what was or was not registered in long term memory; what was retained in long term memory; the ability of the question to initiate recall; and the significance of the question to the perpetrator during the examination process. One would expect that some relevant questions would elicit larger physiological responses than others.

An innocent person, on the other hand, would be expected to respond to some of the relevant questions simply because of the threat some of questions might elicit. However, they should not respond to as many of the relevant questions as a guilty person would, nor should the responses persist upon repeated presentation of the questions. Consequently, the ratio of strong responses to lesser responses should be different for the guilty subjects than for innocent subjects. Therefore, if a test, composed of all event-related relevant questions, could discriminate between guilty and innocent persons, such a test could avoid the major criticisms currently directed at CQT testing procedures.

The purpose of this exploratory study was to determine if a psychophysiological detection of deception test, formatted with all relevant questions, could discriminate programmed guilty subjects who had participated in an espionage scenario, from programmed innocent subjects.

Method

Subjects¹

The subjects were 40 civilians (25 females and 15 males) recruited from the Anniston, Alabama area. Each subject was determined to be in good health, not overly fatigued, sleepy, and not under the influence of drugs. The average age was 29.6 years with a range of 18 to 50 years. Each had not had a PDD test before.

Equipment

A Lafayette Factfinder polygraph, Model 7691U, was used to record breathing and skin conductance activities. A computer interface (Model 76910), an analog-to-digital converter board and AT-Computer Based Oscillograph and Data Acquisition System (AT-CODAS) Level 5.5 software was used to store data in a computer. The cardiovascular activity was recorded using an Ohmeda Finapres 2300 and the data was also stored directly into the computer. The physiological activities were also recorded on polygraph chart paper.

Examiners

Two DoDPI instructors, each with over 5 years experience, as federal examiners, conducted the examinations.

Procedure

Upon arrival at DoDPI the subjects were briefed regarding the nature of the study. Subjects were randomly assigned to innocent (N=20) or guilty (N=20) groups. The guilty subjects were randomly assigned to two subgroups with each subgroup engaging in a different scenario(s). The examiners were blind to these designations. Four subjects per day, for ten days, were involved in the study. All subjects were given an initial briefing as follows:

General Briefing. "This is a study dealing with the ability of psychophysiological detection of deception procedures to accurately record and measure physiological activities to determine if a person is telling the truth or being deceptive when they answer a series of questions about being a designated spy or engaging in an incident or incidents involving mock espionage. Some of you will be designated as spies and asked to commit a staged or mock act or acts of espionage and then take a psychophysiological detection of deception test. Others of you will be given general information about the mock espionage scenario and also undergo a psychophysiological detection of deception test. If you agree to participate, you must maintain your innocence throughout the study, even if you are a designated spy and guilty of committing some of the acts of espionage involved in the scenario. If you have reservations

about being a designated spy, committing mock acts of espionage, or of maintaining your innocence even if you are lying, or about taking a psychophysiological detection of deception test, please feel free to say so and you can be dismissed. All were advised of their rights, signed informed consent forms and reviewed and signed a volunteer agreement. They were then told that "When you meet with the controller, you will be randomly assigned to a particular group and will be given your instructions. Once the assignment is made, it cannot be changed unless you withdraw from the study."

Innocent Subject Instructions. The instructions and directions for the innocent subjects were completed in a private room, one at a time, as follows:

"In a few minutes you will be escorted to the examination room where the examination will be conducted. You will be one of the suspects that is accused of being a designated spy or engaging in one or more act(s) of mock espionage. Since you are not designated as a spy and are not involved in the mock acts or espionage, all you have to do is be completely truthful with the examiner. He will talk with you for awhile to obtain specific and general background information about you. (You may refuse to answer any personal questions.) The examiner will explain the instrument to you and what the procedures will be. He will ask you many questions about being a designated spy and engaging in mock acts of espionage. Just be honest and deny any involvement. He will then attach the various sensors to you and conduct the psychophysiological detection of deception test. It is important that you: (1) pay close attention to what the examiner says; (2) listen closely to his instructions; (3) cooperate fully; and (4) answer all his questions truthfully. Do you have any questions?" All questions were answered in such a manner as to not jeopardize the study.

Guilty Subject Briefing. The instructions and directions for the guilty subjects was also given in a private room, one on one, as follows:

"In this study you have been randomly selected to be a designated spy. This means that as a designated spy you will engage in one or more act(s) of espionage. Here is a name tag that labels you as a designated spy. You are to put this in a safe place, preferably your pants pocket, and not allow anyone to see it. You must not admit to anyone that you are a designated spy. No matter what you are asked, or who asks it, do not let anyone know that you are a designated spy. You are to lie about it at all times.

As a designated spy, you will engage in one or more act(s) of espionage. Again, no matter who asks you or what they ask you, do not admit, nor in any way reveal, that you are a designated

spy, or that you engaged in any acts of espionage. Deny! deny! deny! any questions about espionage acts or being a designated spy. However, you are to be completely truthful about everything else you are "asked" about. If you admit or reveal in any way that you are a designated spy or that you have engaged in mock espionage acts, you will be disqualified from the study. As a designated spy, you need to be aware that there are three categories of classified documents. Documents labeled "confidential" are applied only to information or material the unauthorized disclosure of which reasonably could be expected to cause damage to the national security. Documents labeled "Secret" are applied only to information or material the unauthorized disclosure of which reasonably could be expected to cause serious damage to the national security. Documents labeled "Top Secret" are applied only to information or material the unauthorized disclosure of which reasonably could be expected to cause exceptionally grave damage to the national security. As a designated spy, you are not allowed or authorized to see, take, copy or look at any document marked with any of these classifications".

The 10 individuals randomly assigned to Group 1 were given additional instructions as follows:

"In addition to being a designated spy, you will have to actually engage in an act of espionage. I want you to go down the hall in this building and enter a room marked, "Authorized Personnel Only". You are to go in and shut the door. On the stand to the right of the computer monitor there is a file of classified documents. You are to search through that file until you locate a document marked, "Secret" and "Project Sash". Take this document (Project Sash) from the file and take it to the center office where the copier machine is located. There will be instructions telling you how to use the copier. Following the instructions, make a copy of the two pages that constitute the document. After you finish copying the document, return to the room and place the original document back into the middle of the file. You will then return to this room and negotiate selling the copied document to me. You will start the negotiations by saying, "I have something that I think is of value to you. Are you interested?" The negotiations ended when a \$20.00 figure was reached.

The 10 individuals randomly assigned to Group 2 were, one on one, provided additional instructions as follows:

"In addition to being a designated spy, you will have to actually engage in two acts of espionage. First, I want you to take this camera, which has a special lens for close-up photography, and go down the hall of this building until you find the room marked, 'Authorized Personnel Only'. Enter that room and shut the door. On the stand to the right of the

computer monitor you will find a file of classified documents. You are to search through that file until you find the document marked, Top Secret and Project Windowpane written on it. Remember Top Secret and Project Windowpane. It is the only document with Top Secret written on it. Pull the document out of the file; place it on top of the file. Take a picture of the front of the document. Open the document to the first page. Take a picture of that first page. Turn to the next and last page and take a picture of it also. Return the document to the file. After replacing the document in the file, you must leave the room and return to me. Bring the camera with you. You will start the negotiation by telling me that you have some pictures of a document that you think will be of value to me. I will ask you what document the pictures are of. You will indicate that the document was marked Top Secret and that its name was Windowpane. I will indicate it is of value to me and that I am interested in buying it." Negotiations stopped at \$20.00.

After selling the film to the controller, the subjects were given additional instructions as follows:

"In addition to being a designated spy using a camera, you will engage in another act of espionage. I want you to go to the room marked, 'Absolutely No Unauthorized Personnel.' Go in and shut the door behind you. There will be a computer on the desk. Turn the computer on by turning on the switch on the floor power supply. After it is turned on, the monitor will have a message on it saying that the PC is for processing classified data and access is permitted only by authorized personnel. The computer will ask for a password. You must type in that password--KIMBKATR. This will bring up the main menu on the computer screen. Look for the letter 'W' beside the classified document and press that letter. The classified document marked 'Secret' will come up on the screen. You are to make a copy of this Secret document. You can do this by pressing the key marked 'Alt' and the letter 'P'. The document will print on the printer. Roll the computer paper up with the Secret document printed on it and tear it off. Fold this copy and put it inside your shirt. Turn the computer off by turning off the switch on the floor power supply. Return to this room. You will negotiate by telling me that you have a computer printout that you think will be of value to me. I will ask you what sort of computer printout. You will indicate that the data on the computer print out is marked Secret. I will ask to see the printout and after reading it, I will indicate that the printout is of value to me and that I am interested in buying it." Negotiations ended at \$20.00. All questions were answered in such a manner as to not jeopardize the study. Following the completion of the assigned tasks the subjects were escorted to the examination room.

Pre-Test Interview and Testing Format. When the subject arrived at the testing room, the examiner introduced himself and proceeded with the pre-test interview in a courteous, friendly but businesslike manner. He immediately reminded the subjects that taking the test was completely voluntary, that they had a right to refuse to take the test, to stop the test at any time, to refuse to answer any questions and that their consent was required before the test could proceed.

The pre-test format served to provide background data regarding the subjects physical condition, psychological condition, special training, such as biofeedback, sports, reading interests and educational level, estimate of intelligence and also served as a procedural guide (Exhibit C).

After obtaining the background information, the examiner proceeded to explain the polygraph instrument to the subjects and pointed out that several attachments would be placed on their bodies and, from these, selected physiological activities would be recorded by the instrument. It was also generally explained that the recorded physiological functions were involuntarily produced and rather steady in the rate of activity under normal conditions, but change to mobilize the body when one attempts to lie. And the examiner said "If you are telling the truth when you answer a question, these bodily activities remain normal relative to your current level of nervousness and the circumstances involved. However, when you lie, these functions will involuntarily and immediately mobilize various bodily activities causing changes to appear in the recordings. These changes will be obvious to me and will enable me to determine whether or not you are being truthful when you answer the questions during the test".

After this introduction, the interview proceeded to matters pertaining to the mock espionage. The examiner inquired of each subject, "What is your understanding of why you are here today?" The examiner corrected any misinterpretations expressed by the subjects and then continued with: "It is my understanding that a designated spy went into an office marked 'Authorized Personnel Only' or 'Absolutely No Unauthorized Personnel' and took documents marked 'Secret' or 'Top Secret'; copied them, photographed them or obtained them from a computer and then later sold them. You are suspected of being a designated spy who did some or all of these things. I am going to conduct a test on you to determine if you are being truthful or deceptive about being a designated spy and to having committed some of these acts of espionage".

Test Questions. The areas of inquiry associated with the questions to be asked during the test were explored in broad terms as follows:

"Have you ever voluntarily--or on your own initiative--or of your own free will taken any documents labeled or marked 'Secret' or 'Top Secret'?"

"Have you ever sold, or collected or taken any money for any classified documents?"

"Has anyone ever asked you to get or take any classified documents?"

"Do you know anyone that is a designated spy?"

"Are you a designated spy?"

"Have you ever done anything with 'Secret' or 'Top Secret' documents that you are trying to keep hidden?"

The examiner was given latitude as to how he explored each subject's potential participation in the mock scenario. However, the exploration was not extensive or in an interrogation mode. All test questions were the same for all subjects. The format and the questions used were as follows:

Questions²

1. Is your true first name _____?
2. Is your true last name _____?
3. Have you ever talked to anyone about committing an act of espionage?
4. Have you been contacted by anyone who asked you to obtain materials marked "confidential?"
5. Have you been contacted by anyone who asked you to obtain materials marked "secret?"
6. Have you been contacted by anyone who asked you to obtain materials marked "top secret?"
7. Have you ever been directed to take materials marked "confidential" and later sell them?
8. Have you ever been directed to take materials marked "secret" and later sell them?
9. Have you ever been directed to take materials marked "top secret" and later sell them?
10. Have you ever voluntarily taken classified materials and sold them?

11. Have you ever obtained classified information by using a computer to gain access?
12. Did you ever copy materials marked "secret" that you later sold?
13. Did you ever copy materials marked "top secret" that you later sold?
14. Did you ever photograph materials marked "secret" that you later sold?
15. Did you ever photograph materials marked "top secret" that you later sold?
16. Do you know any designated spies?
17. Are you a designated spy?
18. Have you ever engaged in espionage activities that we have not discussed?

In-test. After the areas of inquiry were explored and the denials firmly established, the examiner proceeded to place the attachments on the subject. While placing the attachments, the examiner explained that for technical reasons some question or questions may be asked more than once and if that happens, it should be considered a technical matter and not to worry about it. He also stated that the test would be run three times. The second run would take place a minute or so after the first run; and, the third run a few minutes after the second run. The examiner made sure that the subject understood the instructions by asking, "What does what I just said mean to you?" The examiner clarified any misunderstanding regarding the repeating of questions or about the second and third runs of the test.

After placing the attachments and making the above statements, the examiner stepped in front of the subjects and told them that during the test they must sit up straight in the chair, not to move, keep both feet flat on the floor, and keep their eyes closed during the test. In addition, the examiner told the subjects that it would take a few minutes to get them properly balanced with the instrument and that the examiner would announce when the test would begin and that the above instructions would be repeated at that time.

The examiner assumed the testing position which was prearranged so that the subjects body, jaw muscles, lips and extremities could be observed. The announcement of test beginning (ATB) was "The test is about to begin. Sit perfectly still, try not to move, answer all questions with a "yes" or "no" and keep your eyes closed during this test." Stimulus

marks were used to identify the beginning and end of the ATB. Approximately ten to fifteen seconds after ATB, the first question was presented, followed by others at twenty-five second intervals. Each stimulus presentation was identified by appropriate stimulation marks and numbers and the answers noted with a plus (+) for yes and a minus (-) for no. Other chart markings and notations were used to identify changes in recordings that were other than physiologically derived. Twenty-five seconds after the last question was asked, the announcement of test ending was given and so identified with stimulation marks. "The test is now over. Continue to sit still and keep your eyes closed for a few more moments." After ten seconds, the subjects were told, "You can relax and open your eyes." The time and date was then recorded on the chart.

Between test runs the examiner spoke to the subject, "You seem to be having a problem with some of these questions. Is there anything you need to tell me?" The examiner answered any questions, or responded to any statement the subject made, in a manner that would not jeopardize the study. The examiner then indicated that the second run would take place. The same ATB was given, the questions were asked in the same order, spacing and ATE were the same. After the second run, the examiner said, "You are still having some problems with some of these questions. Are you sure there is nothing you need to tell me?" Again the examiner answered questions, or responded to any statement the subject made, in a manner that would not jeopardize the study.

The third run followed the same pattern as in the first two runs of the test. After the third run, the examiner removed the sensors, thanked the subjects for their cooperation and advised them to return to the controller.

Post Test. When the subjects returned to the controller, all their questions were answered in a manner that would not jeopardize the study. The guilty subjects were asked to return the money they had been given during the mock espionage phase.

Results

The original examiners were provided rank order scoring sheets. They were instructed to evaluate, independently, each physiological recording. They were to give a score of 3 to the greatest reaction and a score of 3 to all other reactions of similar size; a score of 2 to the next largest response and all similar to it; a score of 1 to the smallest reaction and all like it; and, a zero if there was no reaction. Based on their scoring and their observations during the entire examination, the examiners were asked to make a global diagnosis of DI or NDI. No inconclusives were allowed.

It can be observed in Table 1 that the examiners were accurate on 35% of their calls with the programmed innocent subjects and 65% on the programmed guilty with an overall accuracy of 50%.

Table 1
Accuracy of Examiners Rank Order Scoring and Global Decisions

Programmed	Global Decision		
	NDI	DI	% Correct
Innocent	7	13	35
Guilty	7	13	65
Overall Accuracy			50

Post Hoc Analysis

The digitized data, collected on CODAS, was not evaluated. The voltage stops on CODAS software produced too many voids in the data. Those voids, however, did not affect the polygraph hard copy that the examiners evaluated. The rank order scores, as obtained by the examiners subjective judgements of the physiological data, were used to evaluate four hypotheses:

Hypothesis #1: A programmed innocent person (PIP) will habituate to the signal value of a list of relevant questions faster than a programmed guilty person (PGP). Thus, "there will be a larger average ratio between the total scores of the first run against the third run of the test for the PIPs than for the PGPs." (The average ratio was determined by dividing the subtotal score from test run 1 by the subtotal score from test run 3; adding the ratios and dividing by n for PIP and PGP.)

The average ratio for the PIP, Table 2, was 1.0245 with a S_d of .3247 while for the PGP the average ratio was .8605 with a S_d of .1861. Although the direction of the scores were as predicted, the difference was not significant ($t=1.96$, $df=38$, $p > .05$).

Table 2
Average Ratios of First Run Scores with Third Run Scores for PIP and PGP

	Innocent (N = 20)	Guilty (N = 20)
Mean	1.0245	.8605
Standard Deviation	.3247	.1861

Hypothesis #2: In a test with 18 relevant questions, orienting responses in the early part of the test run and

habituation toward the last half of the test should result in low or negative correlations for PIP. Normal "beginning of test" responses to questions in the early part of the test against questions of high signal value in the last half of the test "will provide a higher average positive correlation for PGP than for the PIP." (The correlations were obtained by correlating question 1 with question 10; question 2 with question 11 and on through to question 9 with question 18. The correlations obtained were averaged for each group.)

As can be observed in Table 3, the mean correlation for the PIP was .0545 and for the PGP .0815, while the S_d 's were .3511 and .4471 respectively. The difference between the two means was not significant ($t = -.0270$, $df = 38$, $p > .05$). However, there were more low (below .20) and negative correlations for the PIP (13), then for the PGP (9).

Table 3
Average Correlations Between the First and Last Nine Questions for PIP and PGP

	Innocent (N = 20)	Guilty (N = 20)
Mean	.0545	.0815
Standard Deviation	.3511	.4471

Hypothesis #3: If the five questions with the lowest scores in the PIP were averaged and subtracted from the average of the rest of the questions in that group, and the same was applied to the PGP, there would be a significant difference between the means of the two groups. The PIP will have a significantly lower average than the PGP.

The average and standard deviations for the two groups are presented in Table 4. The difference was not significant ($t = -.1311$, $df = 38$, $p > .05$).

Table 4
Average of "Norm" Scores and "Balance of Questions" Scores for PGP and PIP

	Innocent (N = 20)	Guilty (N = 20)
Mean	5.22	5.27
Standard Deviation	1.13	1.25

Hypothesis #4: The PGP should have more responses ranked 3 than PIP; and a PIP should have more scores ranked 2 than PGP. Therefore, the average ratio for the PGP will be higher than the

average ratio for the PIP.

It can be observed in Table 5 that the mean for the PIP was .67 and the PGP was .95 with S_d 's of .18 and .21 respectively. The difference between the means was significant ($t=4.4916$, $df=38$, $p<.001$). Since 4 post hoc hypotheses were tested, a Bonferroni adjustment of .0125 sustains the results as significant.

Table 5
Ratio Means and Standard Deviations for Programmed Innocent and Guilty Subjects (N = 40)

Programmed	Mean	Standard Deviation
Innocent (PIP)	.67	.18
Guilty (PGP)	.95	.21

Since there was a significant difference between the two groups, a cut off score of .85 was established by adding 1 standard deviation (.18) to the innocent mean. All scores with a ratio of .85 or lower were diagnosed innocent and all those with ratios .86 or higher were diagnosed guilty. The results can be observed in Table 6. The accuracy in identifying the PIP (85%) was much better than for identifying PGP (70%). The overall accuracy (77%), with no inconclusive calls allowed, compares favorably with other analog studies using other testing procedures.

Table 6
Accuracy of Decisions Using .85 as a Cut-off Score

Programmed	NDI	DI	%
Innocent (N = 20)	17	3	85
Guilty (N = 20)	6	14	70
Combined			.77

Discussion

The results of this study indicate that event-related relevant questions can be used to discriminate between PGP and PIP. The overall accuracy of 77%, with no inconclusive calls allowed, compares favorably with other analog studies using traditional test procedures. The chance accuracy of the examiners, based upon the global diagnostic approach, was not unexpected since the entire procedure was new and different. The Finapres, which was used to avoid blood pressure cuff discomfort that accompanies lengthy tests, did not have prior

established diagnostic criteria; consequently, the examiners were forced to improvise on their assessment of these data.

The reason(s) why hypotheses 1, 2 and 3 were not significant may be many; or, simply that the hypotheses were not logically formulated in regard to how the numbers were used. With hypotheses 1 and 3, the numbers were derived the same way for each test run. Consequently, the chance for habituation to be detected was defeated by the method of scoring. The original reactions "scored 3," for each of the recordings in test run 1, should have been the model for reaction comparisons in test run 2 and 3 rather than establishing a "score 3" for each test run.

The analysis for hypothesis 2 was also self-defeating in that the distribution of what appeared to be high signal value questions were not evenly balanced between the first half and the second half of the test. It could be argued that some of the questions in the last nine spots appeared to have more significance than the first nine and consequently a correlation approach may not be an appropriate one. In addition, an N of nine may also be inadequate for a correlation procedure.

Future studies should be modified to accommodate some of the above and following comments. The examiners complained that they had difficulties keeping the subjects awake because of the length of the test and because the subjects were required to keep their eyes closed during the tests. Although having subjects close their eyes results in a reduction of sensory input that might affect the test, it nevertheless seems to induce sleepiness. How subjects falling asleep and awakening episodically through a test might have affected the outcome of these hypotheses is unknown.

In between tests, the examiner was instructed to tell the subject that they were having trouble with some of the questions and ask the subjects if they wanted to say anything about what might be bothering them. This could have affected the innocent subjects to some degree. Although this assumption is not evident with regard to the outcome of hypothesis #4 (3 errors for innocent subjects), it could, however, have been a factor in the lack of significance for the other 3 hypotheses.

Further investigation should determine if the event-related control procedure used is a viable alternative to other control methods. Since rank order scoring is a crude analysis technique, future research using this PDD format should consider the development of an algorithm to establish better discriminating capability. Additional studies should provide information as to whether the level of accuracy obtained in this study can be sustained or improved upon.

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Footnotes

1. Two subjects were omitted: one because of faulty Finapres operation and one that was observed by an examiner going into a scenario-setting room.
2. These questions were formulated to fit a mock scenario, but were revised from a list of questions that a group of CSP examiners felt should be comprehensive enough to detect a spy in the field. The first two identity questions were considered relevant under espionage conditions.

Appendix A

Informed Consent Form

In this project we are interested in investigating the application of a psychophysiological detection of deception (PDD) test procedure to differentiate innocent from guilty persons involved in a mock espionage scenario.

You will be attached to a polygraph instrument by placing a band across your chest and one across your abdomen and sensor plates on your fingers. Blood pressure and pulse activity will be obtained from a blood pressure cuff placed on your arm. All of the information you provide will be coded by number. Your name will not be associated with any of the data. You may be asked to be a designated spy and to perform mock acts of espionage. During the examination you will be asked questions concerning your being a designated spy, about your participation in the mock espionage scenario and about your background. You may refuse to answer questions regarding your background. Some aspects of this study may be mildly stressful for some individuals.

Participation in all phases of this experiment is completely voluntary and you are free to withdraw from the project at any time during the study. There will be one session lasting from about two to four hours. You will be paid by a contracted employment service for your participation in this study. If you become eligible for a bonus you will receive that on site. Again, participation in all phases of this study is completely voluntary and you are free to withdraw from the project at any time.

Following the study you will be given the opportunity to ask questions concerning the project. You may also contact Dr. William Yankee (205-848-3804) if you have any additional questions after leaving Fort McClellan.

"The Effectiveness of Event-Related Stimuli as a Control Procedure in the Psychophysiological Detection of Deception"

I understand the purpose and procedures by which this study will be conducted. I have been given an opportunity to ask questions regarding this study and all questions have been answered adequately. I understand that I may withdraw from the experiment at any time. With full knowledge and understanding of the above,

I do voluntarily and freely consent to undergo a PDD examination as part of this study.

Signature

Date

Controller Signature

Appendix B

Volunteer Agreement Affidavit

This form is affected by the Privacy Act of 1974.

1. AUTHORITY: 10 USC 3012, 44 USC 3101 and 10 USC 1071-1087.
 2. PRINCIPAL PURPOSE: To document voluntary participation in the Defense Polygraph Institute Program. Your name will be used for identification.
 3. ROUTINE USES: The name will be used for identification and location purposes only.
 4. MANDATORY OR VOLUNTARY DISCLOSURE: Your signature is necessary if you want to be included in this research. if you do not sign, you will not be able to participate in this study.
-

Personal Statement

I, _____, being at least 19 years old do hereby volunteer to participate in a research study entitled The Effectiveness of Event-Related Stimuli as a Control Procedure in the Psychophysiological Detection of Deception (PDD), being conducted by the Department of Defense Polygraph Institute (DoDPI) at the offices of Argenbright, in Atlanta, Georgia. (To confirm my understanding of each statement, please write in your initials in the blank before each statement.)

1. _____ I understand that I am participating in a research study to determine the utility of a psychophysiological detection of deception test procedure in a mock espionage situation.
2. _____ I am aware that I will be spending from two to four hours at DoDPI and that during this time I may be asked to be a designated spy and to participate in mock espionage acts.
3. _____ I understand that I may refuse to answer question pertaining to my personal background.
4. _____ I understand that as a part of this study I will be taking a psychophysiological detection of deception examination, during which I will be asked to sit still for several minutes at a time during the tests while physiological measurements are being recorded from my body.
5. _____ I understand that there are no known dangers or risks arising as a result of my participation in this study.

Personal Statement (Continued)

6. _____ I understand that I will be videotaped during the examination and that the videotape will be maintained for additional study but not longer than five years.

7. _____ I understand that I will be paid by a contracted temporary employment service for my participation in this study and that I may receive a bonus if I cooperate fully.

8. _____ My participation, the nature, duration and purpose of the investigation and the methods by which it is to be conducted have been thoroughly explained to me. I have been given the opportunity to ask questions concerning this study and any such question has been answered to my satisfaction.

9. _____ I understand that I may terminate my involvement in this study at any time and for any reason.

10. _____ Should I have any concerns or complaints concerning this study, I understand that I may contact Dr. William Yankee at 205-848-3804.

11. _____ Should any question arise concerning my rights relating to study-related injury, I should contact the Commander of Noble Army Hospital, Fort McClellan, at 205-848-2200.

Signature

Date

(Please PRINT your name here.)

Witness

(Please PRINT your name here.)

Appendix C

Pre-Test Interview

Personal:

Date _____ Time _____

Test By _____

Signed Warning/Consent Y N

S.E.# _____

Name (Full) _____

A.K.A. _____

Address _____

Telephone _____ Race C B H O

Sex: M F Age _____

General Physical Condition: _____

Medical Information:

Last physical: _____ Results: _____

Reg. medications: _____

HBP? N Y If Yes, how long? _____

Med: _____

LBP? N Y If Yes, how long? _____

Med: _____

Asthma? N Y If Yes, how long? _____

Med: _____

Emphysema? N Y If Yes, how long? _____

Med: _____

Stomach Prob? N Y If Yes, how long? _____

Med: _____

Rheumatic Fever? N Y If Yes, how long? _____

Med: _____

Have you used any controlled substance in the last 24 hours?

N Y

If yes, List:

Jog/Physical activity? _____

How freq? _____

Psychological Condition: N Y (If yes:)

Ever treated by: _____ Diagnosis _____

Treatment/Kind Length

a psychiatrist? N Y

a psychologist? N Y

a social worker? N Y

a counselor? N Y

Estimate of Intelligence: _____

Education:

Years schooling: _____ High school graduate? N Y

College graduate? N Y

Major _____ Minor _____

Special Training:

Bio? N Y Type _____

Amt. Tng. _____ Results _____

Hypnosis? _____ TM: _____

Other? _____

Hobbies: _____

Sports (like): _____

(dislike): _____

Reading: _____

Best book past year: _____

() Explanation of polygraph.

() Explanation of physiological functions.

() Understanding why here.

GO TO TEST FORMAT FOR QUESTION REVIEW.